OHH Progress Report – Fiscal Year 2006

Core Name: Pathogen Source Tracking

Project Title: Pathogen Source Tracking Core

Reporting Period: Oct. 2005 through Sept. 2006

Principal Investigator(s): Jill Stewart

Associate Investigator(s): Principal Investigators for the research projects within the microbiology program who are also associated with the Core. These PIs are: Dr. Jan Gooch (CCEHBR), Dr. Kelly Goodwin (AOML), Drs. Jay Lewis and John Jacobs (Oxford), Dr. Patrick Brown (SCDNR and HML), and Dr. Wayne Litaker (CCFHR).

Background and Rationale:

Detection methods for most microorganisms of public health concern are inadequate. Traditional methods rely on microscopy or cultivation, both of which are labor intensive and only applicable to a limited number of organisms. Assays of indicator bacteria, i.e. coliforms or enterococcus, have been adopted as an alternative to direct detection of enteric pathogens. These indicator assays are slow, requiring over 24 hours to obtain results, and they do not provide information about sources of pollution. Another problem with the indicator system is that their detection may not be indicative of all pathogenic microbes, particularly viruses and protozoa. Rapid and specific microbial methods are needed to assess pathogen presence in coastal oceans, and to estimate risk of exposure among susceptible persons through recreational water use or shellfish consumption. Methods are also needed to track the sources of microbial pollution so that effective remediation strategies and more accurate risk analyses can be developed.

Objectives:

Overall Pathogen and Source Tracking Program goal:
To develop novel techniques capable of rapidly detecting and tracking marine microbes that threaten human health

Pathogen and Source Tracking Core goals:

1. Build capacity within NOAA regarding the detection and tracking of marine microbes that affect public, environmental, and ocean health by coordinating research projects
2. Provide technical support and act as a resource to HML, the wider NOAA community, and other academic and NOAA OHH Centers for issues related to marine microbiology
3. Coordinate reports from and facilitate discussion among research project PIs

Major Accomplishments:

- Continuing conference calls among research PIs despite lack of OHH funding. The communication and efforts by these individuals confirm their dedication to advancing detection technologies.
- Worked to have pathogen detection and tracking recognized as a research priority in a number of forums, including the JSOST National Ocean Research Priorities Plan and Implementation Strategy, in a proposal to the White House Office of Science and Technology Subcommittee on Water Availability and Quality (SWAQ) and in a workshop and whitepaper planning the Integrated Ocean Observing System (IOOS).

Publications/Presentations:

Publications:

Klopchin, J, JR Stewart, LF Webster and PA Sandifer (2007). Assessment of environmental impacts of a colony of free-ranging rhesus monkeys (*Macca mulatta*) on Morgan Island, South Carolina. Environmental Monitoring and Assessment. *In Review*.

Stewart, JR, J Santo Domingo, and TJ Wade (2007). Fecal pollution, public health and microbial source tracking. Ch. 1 *In*: Microbial Source Tracking. J Santo Domingo and M Sadowsky (eds). American Society for Microbiology. Washington D.C. *In Press*.

Stewart, J, JW Daugomah, DE Chestnut, DA Graves, MD Sobsey, and GI Scott (2006). F^{+}RNA coliphage typing for microbial source tracking in surface waters. Journal of Applied Microbiology. 101:1015-1026.

Siewicki, TC, T Pullaro, W Pan, S McDaniel, R Glenn and J Stewart (2006). Models of total and presumed wildlife sources of fecal coliform bacteria in coastal ponds. Journal of Environmental Management. *In Press*. *Corrected Proof, Available online 23 March 2006.*

Stewart, JR, J Vinjé, SJG Oudejans, GI Scott, & MD Sobsey (2006). Sequence variation among group III F^{+}RNA coliphages from waters and swine lagoons. Applied and Environmental Microbiology. 72(2):1226-1230.

Presentations:

Stewart, J.R. (2005). Pathogens and source tracking in South Carolina. Estuarine Interactions: biological-physical feedbacks and adaptations. Estuarine Research Federation (ERF). Oct. 16-20. Norfolk, VA.

P. Brown, J. Gooch, K. Goodwin, J. Gregory, J. Jacobs, J. Lewis, W. Litaker, B. Robinson, J. Stewart (2006). Concentration, Extraction and Detection: Efforts to Overcome Common Issues with Isolating Microbes from Environmental Samples. NOAA Oceans and Human Health Initiative All-PI Meeting. Jan. 18-20. Charleston, SC.

Stewart, J.R. (2006). Pathogen source tracking program at the Hollings Marine Laboratory. NOAA Oceans and Human Health Initiative All-PI Meeting. Jan. 18-20. Charleston, SC.

Stewart, J., D. Sanger, G. DiDonato, B. Robinson & B. Thompson (2006). Microbial water quality of tidal creek systems along the South Carolina coast. The 13th Ocean Sciences Meeting. American Society for Limnology and Oceanography. Feb. 20-24. Honolulu, HI.

Stewart, J.R. (2006). Ocean observing systems and public health. Coastal conference on ecosystem-based approaches to management in the southeast region. UNC Wilmington. March 19-21. Wrightsville Beach, NC.

Stewart, J., P. Brown and F. Holland (2006). Oceans and human health research at the Hollings Marine Laboratory. California and the World Ocean '06. Sept. 17-20. Long Beach, CA.

Application/Technology Transfer Relevant to OHH Strategic Goals

1.0 Scientific Research and Application

- Participated in Pathogen & Source Tracking Research Projects, detailed in separate progress reports.
- Sits on advisory committee for the American Water Works Association Research Federation for a project called "Rapid and simultaneous concentration of microbes in drinking water using ultrafiltration and dielectrophoresis".

2.0 Public Information and Outreach

- Taught Marine Microbiology Module of Marine Biomedicine and Environmental Sciences Program Selective Course, Medical University of South Carolina, 2006.
- Hosted Laura Fleming, Co-Director of the NSF/NIEHS-funded University of Miami Center for Oceans and Human Health for a visit and seminar in Charleston. Among issues discussed is the need to put together a workshop related to concentrating microbes from samples.
- Helped draft pathogens sections of the national Oceans and Human Health Implementation Plan.

3.0 Capacity Building

- Pressed forward on Memorandum of Understanding with Lorraine Backer (CDC) to facilitate collaboration between the NCCOS OHHI and the Centers for Disease Control and Prevention, National Center for Environmental Health.
- Serves on multi-agency microbial source tracking workgroup tasked, among other things, with drafting research priorities document for the White House Office of Science and Technology Subcommittee on Water Availability and Quality (SWAQ).

- Served as rappateur for breakout group identifying human health research priorities for JSOST National Ocean Research Priorities Plan and Implementation Strategy (April 2006; Denver, CO).
- Facilitated session dedicated to incorporating public health in the planned Integrated Ocean Observing System (IOOS) (Jan. 06; St. Petersburg, FL).
- Led breakout session at NOAA Oceans and Human Health all-PI meeting (Jan. 06; Charleston, SC).

Project Abstract:

The Pathogen Source Tracking Core is dedicated to developing new technologies to safeguard the public from pathogen exposure during recreational use of coastal waters or consumption of shellfish. The function of the core is to coordinate research projects, provide technical support to internal and external scientists, and act as a resource for issues related to marine microbiology. To date, the Core has successfully coordinated the research of six PIs who are developing rapid detection technologies for bacterial and viral pathogens, protozoan parasites, and toxin-producing algae. Despite a lack of OHH funding for most of the research PIs during FY06, the group has decided to continue regular conference calls, allowing continued communication regarding concentration of microbes from environmental samples. During this time period, the Core has worked to have pathogen detection and tracking recognized as a research priority in a number of forums, including the JSOST National Ocean Research Priorities Plan and Implementation Strategy, and in less formal plans for the White House Office of Science and Technology Subcommittee on Water Availability and Quality (SWAQ) and the Integrated Ocean Observing System (IOOS). Overall, it is expected that techniques developed within the pathogen and source tracking program, coordinated by the Core, will allow rapid, cost effective, and specific identification of marine microorganisms of public health significance.

Unresolved Issues:

- Underfunding of Oceans and Human Health Initiative is impeding progress in development of tools to detect pathogens through inability to buy equipment and supplies, retain technicians, and support collaborations.
- One of the difficulties associated with direct detection of human pathogens is applying an efficient method for sample concentration and purification. For many pathogens of interest, only a few infectious units are required to cause human illness. Detection of such low concentrations of microbes requires concentration of the organisms from large volumes (1 to 100L) of water. Proposed methods, including filtration, for concentrating pathogens from large volumes of water are inadequate due to procedural complexity and low and variable recovery efficiencies. The Core plans to develop and compare protocols for isolating microbes from water and will share this expertise throughout the program and with other environmental health microbiologists.

Budget Summary:

	OHH funds	matching (base funds)	Total
Year 1	$0	$24,000	$24,000
Year 2	$44,500	$56,000	$100,500
Year 3	$0	$56,000	$56,000
Total	$44,500	$136,000	$180,500